BROOKHAVEN NATIONAL LABORATORY (BNL)

Site Utilization and Management Plan (SUMP)

July 5, 2006

ACRONYMS AND ABBREVIATIONS

ACI	American Competitiveness Initiative
AGS	Alternating Gradient Synchrotron
ANL	Argonne National Laboratory
ASCR	Office of Advanced Scientific Computing Research
ATF	Accelerator Test Facility
BER	Office of Biological and Environmental Research
BES	Office of Basic Energy Sciences
BES (IHEP)	Beijing Electron Spectrometer at the Institute of High Energy Physics
BGRR	Brookhaven Graphite Research Reactor
BHSO	Brookhaven Site Office
BNL	Brookhaven National Laboratory
BSA	Brookhaven Science Associates
CAC	Community Advisory Council
CD-0	Critical Decision Zero (Approve Mission Need)
CD-1	Critical Decision One (Approve Alternative Selection and Cost Range)
CFN	Center for Functional Nanomaterials
CTN	Center for Translational Neuroimaging
DART	Days Away, Restricted or Transferred
DEI	Diffraction Enhanced Imaging
DESY	Deutsches Elektronen-Synchrotron
DHS	Department of Homeland Security
DOE	Department of Energy
EBIS	Electron Beam Ion Source
EENS	Energy, Environment & National Security
EERE	Office of Energy Efficiency and Renewable Energy
EM	Office of Environmental Management
EMs	Electron Microscopes
ESSH	Environmental, Safety, Security and Health
FACE	Free Air Carbon Dioxide Enrichment
FEL	Free Electron Laser
fMRI	Functional Magnetic Resonance Imaging
FY	Fiscal Year
HEP	Office of High Energy Physics
HFBR	High Flux Beam Reactor
ILC	International Linear Collider
ISM	Integrated Safety Management
ISR	Intersecting Storage Rings
JPSI	Joint Photon Science Institute
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LARP	LHC Accelerator Research Project
LBNL	Lawrence Berkeley National Laboratory
LEAF	Laser Electron Accelerator Facility
LEEM/PEEM	Low-energy electron/photoemission electron microscopy
LHC	Large Hadron Collider
MIT	Massachusetts Institute of Technology
LSST	Large Synoptic Survey Telescope

M&O	Management and Operating
NASA	National Aeronautics and Space Administration
NE	Office of Nuclear Energy, Science and Technology
NIH	National Institutes of Health
NNSA	National Nuclear Security Administration
NP	Office of Nuclear Physics
NRC	Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NSAC	Nuclear Science Advisory Committee
NSF	National Science Foundation
NSLS	National Synchrotron Light Source
NSLS-II	The future National Synchrotron Light Source
NSRL	NASA Space Radiation Laboratory
OA	Office of Independent Oversight & Performance Assurance
OMB	Office of Management and Budget
PART	Program Assessment Rating Tool
PBMC	Performance-Based Management Contract
PEMP	Performance Evaluation and Management Plan
PET	Positron Emission Tomography
QCD	Quantum Chromodynamics
QCDOC	Quantum Chromodynamics On a Chip
R&D	Research and Development
RADTEC	Radiation Detector Testing and Evaluation Center
RHIC	Relativistic Heavy Ion Collider
RPI	Rensselaer Polytechnic Institute
S&T	Science and Technology
SC	Office of Science
SLAC	Stanford Linear Accelerator Center
SNL	Sandia National Laboratory
SNS	Spallation Neutron Source
STEM	Scanning Transmission Electron Microscope
SUMP	Site Utilization Management Plan
TEM	Transmission Electron Microscopy
TRC	Total Recordable Cases
TYSP	Ten Year Site Plan
USNDP	U.S. Nuclear Data Program
UV/IR	Ultraviolet/Infrared
WDTS	Workforce Development for Teachers and Scientists
WFO	Work for Others

1. BACKGROUND/STRATEGIC POSITIONING

The Office of Science (SC) is the single largest supporter of basic research in the physical sciences in the United States, providing more than 40[1] percent of total funding for this vital area. SC is the principal federal funding agency of the Nation's research programs in high-energy physics, nuclear physics, and fusion energy sciences, and manages world-leading programs in Biological, Chemical, and Materials Sciences, as well. It also operates ten world class national laboratories, of which Brookhaven National Laboratory (BNL) is one.

BNL is a premier multidisciplinary laboratory that is recognized worldwide for its research into the nature of nuclear matter, materials, biomedical and climate sciences and for the design, construction, and operation of large-scale, cutting edge research facilities. With an annual budget of approximately $500 million, BNL is one of the largest employers in Eastern Long Island, with a staff of ~2,700. Its 359 buildings are located on about 5,300 acres on the western edge of Suffolk County's environmentally important Pine Barrens. Two BNL facilities, the Relativistic Heavy Ion Collider (RHIC)-Alternating Gradient Synchrotron (AGS) Complex and the National Synchrotron Light Source (NSLS) account for the majority of the 4,000 annual users who come to BNL to pursue their scientific quests. With the Center for Functional Nanomaterials (CFN) under construction and the possibility that NSLS-II, the world's brightest and most powerful synchrotron will be constructed at BNL, the number of users is expected to increase.

As an SC laboratory, BNL is strategically aligned with the goals of SC by playing a dominant role to assure "the U.S. maintains scientific primacy in the key research disciplines that (the Office of Science) supports, that its science programs are relevant and useful for identified national priorities, and that it is agile enough to respond to emerging scientific challenges (from the Office of Science Strategic Plan, 2004)." To ensure its long term health and vitality as a steward of SC's world-leading science and technology, BNL's vision is to bring the power of science and technology to bear on questions that are of utmost significance to the U.S. taxpayer and the DOE, with the goal of becoming the best science laboratory in the world in chosen areas. In pursuing answers, BNL works in cross-disciplinary teams in collaboration with other universities, private entities, other national and industrial laboratories and also participates in training the next generation of scientists. SC's Business Plan and Brookhaven's Ten Year Site Plan, envision that BNL will:

- Be the world-leading laboratory for high-energy nuclear and spin physics research.
- Become a world leader in the fabrication and characterization of materials and systems at the nano scale.
- Use translational biomedical imaging to understand and treat addiction.
- Become a world-recognized laboratory in energy R&D that is leading in the development of advanced materials and processes for selected energy applications.

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[1] *Source: National Science Foundation, Division of Science Resources Statistics, Federal Funds for Research and Development: Fiscal Years 2003–05, NSF 06-313, Project Officer, Ronald L. Meeks (Arlington, VA 2006).*

- Become known as a world leader in Computational Science.

- Maintain a stake in business lines for which BNL is nationally and international recognized.

BNL's path forward relies on leveraging its existing distinguished capabilities and core competencies in order to succeed. BNL plays a vital role in the American Competitiveness Initiative (ACI), as outlined in President Bush's 2006 State of the Union Message. The ACI focuses on basic research programs in the physical sciences that are most likely to contribute to long term economic competitiveness "such as nanotechnology, supercomputing and alternate energy sources."

To date, six Nobel Prizes have been awarded for discoveries made at BNL. In addition, according to a recent ranking by Essential Science Indicators, BNL falls in the top 20 of 578 global institutions for physics paper citations between 1995 and 2005, in Institute for Scientific Information-indexed physics journals. BNL's Relativistic Heavy Ion Collider (RHIC) was hailed as a top 2005 science story. The American Institute of Physics News designated the formation of "Perfect Liquid" in RHIC as the number 1 physics story while Discover Magazine called it the top ranked physics story. It was widely published world wide including but not limited to USA Today, Science News, Newsday and the New York Times. Each publication named RHIC as the top ranking discovery in physics in 2005. This stands as a testament to BNL's outstanding programs in physics.

2. IDENTIFICATION OF DOE PROGRAM OFFICES

BNL receives the majority of its support, in the order of current investment, from the SC Offices of Nuclear Physics (NP), Basic Energy Sciences (BES), High Energy Physics (HEP), and Biological and Environmental Research (BER) with smaller efforts supported by the Office of Advanced Scientific Computing Research (ASCR), and Workforce Development for Teachers and Scientists (WDTS). This enables a broad spectrum of research sponsored by most SC program offices, including experimental and theoretical nuclear physics and RHIC operations (NP); materials, chemical, plant, and condensed matter sciences and NSLS operations (BES); theoretical and experimental high energy physics, primarily focused on support for the ATLAS detector at CERN (HEP); aerosols and clouds, radiotracers and imaging, environmental remediation research (BER), and computation (ASCR).

Substantial support also comes from other non-SC DOE program offices, notably the National Nuclear Security Administration (NNSA), mainly for international material protection and cooperation and from the Office of Environmental Management (EM) for reactor decontamination and decommissioning. BNL runs other small non-SC DOE research programs, the largest of which are funded by the Office of Nuclear Energy, Science and Technology (NE), and the Office of Energy Efficiency and Renewal Energy (EERE). A complete breakdown by client of the current and planned budget through FY08 is presented in Section 3.

2.1 Description of Major Business Lines

It follows from the identification of DOE Program sponsors above that BNL brings a diverse portfolio of science and technology to the DOE/SC Laboratory complex. BNL's three major business lines (articulated in the SC Business Plan) are

Nuclear Physics, Basic Energy Sciences, and Bio-medical sciences. Each is aligned with the missions of NP, BES, and BER and has world-leading capabilities that distinguish its performance. This section describes some of the exceptional science underlying BNL's Business Lines as they exist today and lays the groundwork for the science of the future presented in the section entitled "Projection of Business Line Activities" (section 2.4).

Nuclear Physics (NP)

The overarching goal of BNL's program in nuclear physics is to play a major role in determining the structure of the nucleon and the properties of hot nuclear matter, two areas central to nuclear physics that are explicitly called out in The Office of Science Strategic Plan: Explore Nuclear Matter from Quarks to Stars. Research is carried out experimentally at RHIC and computationally by the Nuclear Theory and Lattice Gauge Groups who exploit BNL's teraflop computing capabilities.

For the present,

- RHIC is a world-leading nuclear physics accelerator complex, designed to facilitate an understanding of the properties of nucleons and the nature of the quark-gluon plasma. It is a unique accelerator worldwide for symmetric or asymmetric nucleus-nucleus collisions. It also has a unique capacity to deliver polarized protons to study the origin of the spin of the proton.

- The Nuclear Theory Group at BNL, which conducts a vigorous theoretical program aimed at understanding the fundamental structure of matter created at RHIC, is the world's most highly cited nuclear theory group. One of its major efforts is to elucidate the origin of the spin of the proton. The Lattice Gauge group, headed by a world-leading theorist, has a synergistic relationship in supporting the RHIC heavy ion experimental program.

- The National Nuclear Data Center, also funded by NP, is considered to be the world leader. To quote from the U.S. Nuclear Data Program (USNDP) FY 20004 Final Report, "…the National Nuclear Data Center is the core facility of the USNDP. It has the main responsibility for national and international coordination…" The number of data retrievals (~700,000 in FY05) far exceeds that of any other nuclear data center.

In the future,

- DOE's vision is to evolve the RHIC complex to the QCDLab at RHIC to assure that its world leadership role is maintained, i.e., BNL will continue to be the world-leading laboratory for high-energy nuclear and spin physics research.

Basic Energy Sciences (BES)

The scientific themes of BNL's programs in Basic Energy Sciences are aligned with DOE's "grand challenge" initiatives. These include themes in nanoscience,

strongly correlated systems, catalysis/hydrogen, radiation chemistry and chemical kinetics, chemical dynamics, and the interface of the life and physical sciences. All of these themes offer new approaches to address the energy security challenges facing the U.S. by "advancing the core disciplines of basic energy sciences, leading the nanoscale science revolution, and mastering the control of energy-relevant complex systems" (from the Office of Science Strategic Plan: Advance the Basic Sciences for Energy Independence). The distinguishing BES research facilities are the NSLS and the CFN.

For the present,

- The NSLS is a center of scientific excellence. It attracts world leading researchers in almost every scientific field who produce more than 700 publications every year using the NSLS. Notably, a visiting researcher garnered the 2003 Nobel Prize in Chemistry for structural studies of ion channel proteins performed predominantly at the NSLS. A five year strategic plan that will outline the course for future operation and development of the NSLS is scheduled to be completed by the end of summer 2006.

- The coordinated facilities of the CFN include forefront capabilities in nanopatterning; nanomaterials synthesis; transmission electron microscopy; ultrafast laser sources; powerful probes that image atomic and molecular structure; theory and computation; CFN endstations at the NSLS; and access to the Laser Electron Accelerator Facility (LEAF). As of 5/1/2006, the CFN accepted 130 user proposals.

- BNL's programs in strongly correlated systems and in fuel cell nanoparticle synthesis and reactivity are considered to be among the best in the world, based on the number of citations and peer review, respectively.

In the future,

- BNL will become a world leader in the fabrication and characterization of materials and systems at the nano scale and a world-recognized laboratory in energy R&D that is leading in the development of advanced materials and processes for selected energy applications by enhancing the NSLS, beginning operations at the CFN, and building NSLS-II.

- Novel x-ray and UV/IR techniques developed at the NSLS will take on a unique role at NSLS-II, which will provide the world's finest tools for x-ray imaging and spectroscopy with capabilities at the nanoscale.

Bio-medical Sciences (BER)

The emphasis of BNL's medical imaging program is to utilize the laboratory's capabilities to develop tools and techniques to understand how the brain develops, changes, and adapts to the environment over a lifetime (through the combination of expertise in radiotracer chemistry, imaging physics, and preclinical and clinical neuroscience). In doing so, BNL will "master the convergence of the physical and the life sciences to deliver revolutionary

technologies for health and medical applications" in line with SC Strategic Plan goal: Harness the Power of Our Living World.

For the present,

- The Center for Translational Neuroimaging (CTN) is a world leader in radiotracer development and the use of innovative technological approaches in Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI) for imaging the human brain (and other organs).

- BNL is a world leader in studying the impact of addiction on the brain. BNL's preeminence is validated by major external scientific awards (National Academy of Sciences, National Institute of Medicine, American Chemical Society National Awards, Presidential Early Career Award for Scientists and Engineers, DOE/BER Medical Sciences Distinguished Fellow, etc.) to several staff members.

In the future,

- A goal for BNL is to translate developments in biomedical imaging to the understanding and treatment of addiction.

- Expand the effort to create new instrumentation to aid in determining the causes of addiction and eventually in their treatment

- Grow collaborations with regional medical institutions to increase the range of research and the translation of that research to practice

2.2 Description of Secondary Business Lines

The Laboratory has a stake in other business lines for which it is nationally and internationally recognized. They are:

High Energy Physics (HEP)

BNL is involved in several high priority HEP efforts (often in leadership positions) that will search for possible Physics Beyond the Standard Model in support of the SC goal: Explore the Fundamental Interactions of Energy, Matter, Time, and Space. Five Nobel Prizes were awarded for discoveries at BNL in this area.

For the present, BNL:

- Serves as the host laboratory for U.S. participation in the LHC ATLAS experiment at CERN that will manage the U.S. roles in physics research, computing, and future upgrades.

- The Accelerator Test Facility (ATF), a unique national resource for the study of beam physics, is BNL's world-class HEP facility that attracts accelerator and beam physicists from all over the world.

- Manages the LHC Accelerator Research Project (LARP) for the LHC luminosity upgrade.

- Plays a role in high energy theory, advanced accelerator R&D, and International Linear Collider (ILC) detector R&D.

In the future,

- BNL's core competency in particle physics and advanced accelerator and detector design enables many roles in HEP research. BNL is involved with studies for the continuation of muon g-2 at the AGS, the Large Synoptic Survey Telescope (LSST), a neutrino experiment (Daya Bay), and the ILC.

Climate Change Science (BER)

BNL's ultimate goal is to improve climate models and increase the ability to distinguish between natural and anthropogenic climate change in support of the Office of Science Strategic Plan Goal: Unravel the mysteries of Earth's changing climate. The Free Air Carbon Dioxide Enrichment (FACE) facility in the Duke Forest is BNL's premier BER-supported facility.

For the present, BNL is:

- A U.S. leader in atmospheric chemistry, particularly studies related to the creation and evolution of aerosols, and their role in the global radiation balance.

- Home to the Chief Scientists for the DOE Atmospheric Science and Atmospheric Radiation Measurement Programs.

For the future,

- BNL is developing a core competency in cloud radar.

Nuclear Safety (NRC)/(DHS)

- BNL is the U.S. co-leader (with Sandia National Laboratory (SNL)) in risk assessment, structure analysis, and review of license requests for nuclear reactor licensing and regulation.

- The largest segment of BNL work for the Department of Homeland Security (DHS) is the RADTEC project, wherein BNL provides a technical and engineering facility to enable a standardized, technically-defensible approach for benchmarking radiation detectors used to detect nuclear contraband. This work is projected to grow through FY08.

- The goal of the Urban Dispersion Program is to better characterize the behavior of toxic contaminants potentially released within a large urban environment such as New York City. BNL's contribution to the Urban Dispersion Program include the design, construction , and deployment of

meteorological monitoring equipment and the controlled release and subsequent sampling and analysis of the dispersion of perfluorcarbon tracer gases that act as simulated contaminants. This work is cone as a part of broad university, national laboratory, and federal facility collaboration; the BNL portion is anticipated to remain at a constant level of effort.

2.3 Laboratory Core Competencies

BNL's core competencies lie in five areas that map to the mission and history of the Laboratory. They are the cornerstones of current research that will ensure the future strength and uniqueness of BNL's major initiatives. They are:

- **Design, construct, and operate extraordinary facilities**

  Since its creation as a national laboratory to promote research in the physical, chemical, biological, and engineering aspects of the atomic sciences, BNL's capacity to provide facilities that individual institutions could not afford to develop on their own has been a key element of its mission. In FY 2005, BNL served ~4000 users at its major user facilities:

  - The Relativistic Heavy Ion Collider (RHIC)
  - The National Synchrotron Light Source (NSLS)
  - The NASA Space Radiation Laboratory (NSRL)
  - The Alternating Gradient Synchrotron (AGS)
  - The Accelerator Test Facility (ATF)
  - The Tandem Van de Graaff
  - The Free Air Carbon Dioxide Enrichment (FACE) facility in the Duke Forest
  - The Scanning Transmission Electron Microscope (STEM)
  - The Center for Functional Nanomaterials (CFN) (through the jumpstart program)

- **Advanced concepts of accelerators, detectors, magnets, and instrumentation**

  Expertise in innovative particle accelerator, magnet, and source development coupled with the capability to develop state-of-the-art detectors and electronics has enabled BNL to become a world leader in this arena where it continues to develop new ideas. Among BNL's "advanced concepts", which have been incorporated in the design of accelerators around the world (shown in parentheses), are the following:

  - Strong focusing (all electron and hadron synchrotrons)

- High brightness electron guns (worldwide standard, including Argonne National Laboratory (ANL) and Stanford Linear Accelerator Center (SLAC))
- High gain harmonic generation (the basis for FEL projects under design/consideration at Lawrence Berkeley National Laboratory (LBNL), MIT, Elettra, Pohang Light Source, China)
- Direct-wind superconducting coils (PETRA at DESY, BES at IHEP Beijing, and the basis for the only known workable design for the ILC beam delivery and final focus systems)
- 2-in-1 collider magnets (LHC)
- Design, manufacture, and test accumulator ring and beam transport lines for the Spallation Neutron Source (SNS).

Examples of state-of-the-art detectors invented at BNL and deployed elsewhere are:

- Liquid argon-based calorimeters (ISR at CERN, D0, ATLAS)
- Silicon drift detectors (HEP experiments, future ALICE at CERN, electron microscopes, the European Space Agency X-ray Multi-Mirror Newton satellite)
- 2-D area detectors for neutrons and x-rays (SNS, LANSCE)
- A variety of sensors that can detect trace amounts of nuclear, chemical, or biological agents, and explosives.

- **Synchrotron radiation science and technology**

The success of the NSLS as a vital resource for the research of ~2,400 users per year in the energy, life, and environmental sciences derives from scientific expertise in how radiation interacts with matter. In order to preserve and enhance the outstanding productivity of its user community, NSLS scientists design and construct insertion devices, optics and detectors, and novel instrumentation. Complementing this is an infrastructure for user support, and for upgrading beamlines and instrumentation for endstations. Contributions from BNL that have shaped synchrotron radiation S&T include:

- The Chasman-Green lattice (variants used in all modern synchrotrons)
- Global feedback systems (all modern synchrotrons)
- Small gap undulators (in collaboration with SPring8, many synchrotrons)

- **Imaging expertise**

  BNL has a distinguished history in radiotracer chemistry and imaging instrumentation development that is beginning to provide an understanding of the abnormal metabolism of the brain and other organs in multiple disease states. In addition, a wide range of imaging techniques, carried out at the Laboratory's premier research facilities, allows for imaging structures from atoms to mammals. Some distinctive methods and applications include:

  - PET/fMRI (awake animal)
  - Diffraction enhanced imaging (DEI) (soft tissue, such as breasts)
  - Cryo-electron microscopy (Cryo-EM) (single protein molecules)
  - Spectromicroscopy (cells and tissues)
  - Transmission electron microscopy (TEM)/X-ray (holographic imaging of magnetic structures)
  - Low-energy electron/photoemission electron microscopy (LEEM/PEEM) (nanoparticle dynamics and reactivity)
  - Neutron and gamma cameras (national security)

- **Tera (peta)-scale computing**

  BNL operates two 10 Teraflop QCDOC supercomputers, one funded by RIKEN, with infrastructure support from SC, for lattice gauge calculations in QCD and the other, funded by SC, for use by members of the U.S. Lattice Gauge Theory community, as well as for applications in nanoscience and computational biology. BNL also runs large scale computing farms, i.e., the RHIC Computing Facility and the U.S. ATLAS Tier I Computing Center, which provide vital computing capacity for complex data analysis.

2.4 Projection of Business Line Activities: Programmatic Growth

BNL is growing now and will continue to grow over the next ten years. The CFN is currently under construction, to be followed shortly thereafter by the Electron Beam Ion Source (EBIS), the first upgrade to RHIC, which received DOE's CD-1 approval in the fall of 2005. Leveraging the research that is being carried out at the current NSLS and the CFN has caused DOE to state its preference to site NSLS-II at Brookhaven National Laboratory. BNL is beginning to prepare a compelling case for CD-0 for RHIC-II and for the evolution of RHIC to the QCDLab at RHIC to be presented in the 2006/7 NSAC Long Range Plan. Two new Lab initiatives in energy R&D and computational science are being prepared.

Building on its suite of core competencies, the major initiatives which will ensure the long term strength of BNL's business lines and catalyze program growth are:

- NSLS-II
- Evolution of RHIC to a QCDLab
- Nanoscience
- Translational Neuroimaging
- Energy
- Computational Science

NSLS-II

The NSLS has served a large community of researchers and users for over 23 years. However, the NSLS has reached its theoretical performance limits after many stages of improvement over its history. This increasingly limits the scientific productivity and hence impact of its user community.

In order for the discovery potential of the NSLS to continue beyond the next decade, DOE has approved plans to upgrade its capability by constructing the world's forefront synchrotron light source, NSLS-II, a fully-optimized 3rd generation storage ring, together with advanced insertion devices, optics, detectors, and a suite of scientific instruments. NSLS-II will deliver the world's best performance in terms of brightness and flux, an increase over those of the current NSLS by more than 10,000 times and 10 times, respectively and with unprecedented stability. Its advanced optics will produce world-leading spatial resolution of 1 nm and energy resolution of 0.1 meV. Secretary Bodman has stated the Department's preference to locate the NSLS II at BNL.

The unique characteristics of NSLS-II will open up new regimes of scientific discovery and investigation, and enable exploration of the correlation between nanoscale structure and function, the mechanisms of molecular self-assembly and the science of emergent behavior, especially for correlated electron systems; most importantly, these are precisely the challenges for Basis Energy Sciences posed in the Office of Science Strategic Plan.

The scientific and technical teams necessary for the success of NSLS-II are being built around the core competencies in advanced concepts, extraordinary facilities, imaging expertise, and synchrotron radiation S&T, which are either stable or thriving. Ultimately, NSLS-II will benefit DOE and the taxpayer by advancing nanoscale science that will lead to improved energy technologies and systems. It will provide the Nation's science community access to a world leading research facility, and U.S. industry a competitive advantage for new materials and technologies beyond silicon. Toward this end, DOE granted CD-0 status to NSLS-II at the end of FY 05.

An important result of the CD-0 approval was the receipt of a commitment from New York State to build a Joint Photon Science Institute (JPSI), provided that the NSLS-II is sited at BNL. JPSI would complement NSLS-II and would serve

multiple purposes. The Institute would serve as an intellectual center for the development and application of photon sciences, as a gateway for light source users and would further serve to promote future program growth.

Evolution of RHIC to a QCDLab at RHIC

RHIC has already had a tremendous impact in nuclear physics, science, and society, with over 100 papers, >5,000 citations, and a comparable body of theory papers. Furthermore, the April 2005 announcement by RHIC's four large detector groups that RHIC's heavy ion collisions are producing a liquid (instead of the postulated gas) tops the American Institute of Physics' list of top physics stories for 2005, as well as being cited at year end by Science News, USA Today, and Discover. Furthermore, RHIC is an outstanding educator of nuclear physicists. The four RHIC experiments have produced close to 100 Ph.D. students, with more to come. QCDLab will train the next generation of scientists.

The discoveries at RHIC have led to compelling questions about QCD and vice versa. Compelling questions have in turn prompted the need for evolution of the facility to further the study of QCD experimentally and theoretically. The expectation is that the evolution of RHIC to the QCDLab at RHIC will play a major role in nuclear physics well into the next decade when coupled with high-end computing capability (QCDOC and Blue Gene/L) for next-generation lattice QCD simulations. BNL's core competencies in extraordinary facilities, tera (peta) scale computing, and advanced concepts needed for this project are either thriving or stable.

Past support for RHIC evolution from NSAC was enthusiastic, which prompted DOE to include RHIC-II and eRHIC in "Facilities for the Future of Science: A Twenty-Year Outlook".

Nanoscience

Nanoscience offers a new approach to address the energy security challenges facing the U.S. through the development of materials exhibiting novel and unprecedented functionality for energy manipulation and utilization. BNL will focus on nanostructured catalysts, electronic nanomaterials, and bio/soft nanomaterials and interfaces, the scientific themes of the CFN, in order to develop the scientific foundation and tools for the design and creation of functional nanomaterials.

Nanoscience is an emerging field. BNL will forge leadership programs in energy, hence making its activities unique in the world. A clear advantage of the CFN is its proximity to the NSLS (and in the future to NSLS-II) and existing programs that are related to the scientific themes of the CFN. All five of BNL's core competencies will ensure the health of nanoscience.

The potential benefit of BNL's nanoscience program to DOE and the taxpayer is breakthrough science leading to revolutionary technologies in energy conversion, storage, and utilization that will impact the H-economy, solar energy, and environmental protection. It will enable open access to world-leading integrated

science programs and facilities, and with the other Nanoscience Research Centers, maintain U.S. competitiveness in nanoscience.

Translational Biomedical Imaging

The scope of this initiative is to translate BNL-developed imaging techniques and capabilities into clinical use, a goal of the Center for Translational Neuroimaging (CTN). To accomplish this, BNL will develop collaborations with neighboring research hospitals, forefront PET and fMRI capabilities for animal and human studies, and new tools based on core strengths in the physical sciences. Just recently, the Laboratory entered into an agreement with Mount Sinai School of Medicine that will provide BNL access to a broad base of research patients to facilitate improvements in the understanding, diagnosis, and treatment of disease and to enable joint submissions for NIH grants. Over the next few months, it is possible that agreements will be in place with two other nearby medical institutions.

DOE's long term investment in radiochemistry and imaging instrumentation at BNL is having a real payoff, especially with the CTN's body of highly regarded results on addictive behaviors. As the CTN develops an understanding of and potential treatment for addiction, and offers an improved understanding of brain chemistry and its effect on human behavior, the potential benefit to humanity will be transformational.

Energy

DOE's overarching mission is "to advance the national, economic, and energy security of the U.S." with the goal of "protecting our national and economic security by promoting a diverse supply and delivery of reliable, affordable and environmentally sound energy." Using its portfolio in energy R&D, DOE will accomplish this by placing an increased emphasis on integrating basic energy science research with energy technology development. President Bush elevated energy to the national consciousness in February when he launched the Advanced Energy Initiative that outlines an aggressive plan to help the U.S. move beyond our dependence on fossil fuels through expanded development of alternative energy sources.

BNL aspires "to be a world-recognized laboratory in energy R&D that is leading the development of advanced materials and processes for energy applications." The strategy for doing so is science-based and focused on long range R&D with a strong nanoscience component. It aims to capitalize on the multidisciplinary nature of BNL by fostering joint projects that build on nanoscience, core, newly-funded and planned programs with the potential to contribute to finding solutions to unmet challenges (such as cost-effective solar energy conversion and catalysis).

The four areas of concentration are catalysis, high-performance materials, solar energy, and biologically-derived fuels, of which the first three have direct connections to nanoscience efforts.

Among the activities that have strengthened the Laboratory's Energy posture are participation in the DOE Laboratory Working Group, the Battelle Nanoscience Alliance, and a new collaborative effect with the Korean Institute for Science and Technology. In addition BNL interacts routinely with the Columbia Nanocenter and is developing partnerships with several New York energy and nanotechnology centers, such as the RPI Energy Center and the Albany Nanotech Center. For fuel cell catalyst testing, staff are working with Los Alamos National Laboratory (LANL), Plug Power, and Battelle Memorial Institute; in microbial hydrogen production, with National Renewable Energy Laboratory (NREL), and with the RPI Solid State Lighting Center, and in the future, with the SUNY Energy Technology Center.

Computational Science

One of the elements in BNL's vision is to become a world leader in computational science. As mentioned above, BNL's core competency in tera (peta) scale computing derives from two 10 Teraflop Quantum Chromodynamics on a Chip (QCDOC) supercomputers and large scale computing farms, i.e., the RHIC Computing Facility and the U.S. ATLAS Tier I Computing Center. The plan for an extensive program in computation is evolving, with new developments unfolding rapidly. The immediate future of computational science at BNL will be driven by the strength of QCD/lattice gauge and nanoscience/materials science theorists who are currently using the QCDOC machines "to deliver computing for the frontiers of science" (Goal 6 of the SC Strategic Plan). In fiscal year 2007, a hundred teraflop computer, Blue Gene/L will be purchased with funds provided by New York State which will strengthen the computational program.

2.5 Interrelation Among Business Lines

From the preceding discussion, it is clear that the link between NSLS and the CFN, and the expected synergy between the CFN and NSLS-II are two of the compelling reasons for the preference to site NSLS-II at BNL. BNL's energy strategy is at the heart of the science that will be undertaken at NSLS-II, the CFN and across the Laboratory. It strongly couples to core programs in BNL's BES, NSLS, Life Sciences and Energy, Environment & National Security (EENS) Directorates and relies on the cutting-edge capabilities of the current NSLS. Biomedical Imaging also has threads that connect it to NSLS-II and nanoscience. While computation is highly developed in Nuclear and High Energy Physics and a necessary component of QCDLab, it is the nucleus for future computation that will eventually comprise nanoscience and biology too.

If BNL is fortunate to launch both NSLS-II and QCDLab, the timing of their construction does not overlap and will not lead to competing mission objectives.

2.6 Internal, External, and Local Area Considerations

- BNL has made marked improvements in how it is viewed externally. In contrast to just prior to a change in Management and Operating contractors in 1998, BNL now has the support of the DOE, U.S. Senate, New York State Congressional delegation, New York State, local governmental entities, the

user community, and the media. The need to preserve and enhance these relationships is essential for long-term health.

- BNL maintains an excellent relationship with the local community. This is fostered through monthly meetings with the Community Advisory Council (CAC), which keep the community apprised of scientific and operational initiatives and concerns.

- To ensure success in programs critical to the long term health of the Laboratory, BNL partners with other DOE Laboratories and participates in numerous national and international collaborations.

- Partnering Agreements with state, university, community, and other business entities are critical to success. The largest commitments recently include $26M for a BlueGene/L supercomputer, $30M for JPSI provided NSLS-II is sited at BNL (both from New York State) and $13M from private investors at Renaissance Technologies, Inc. for RHIC operations in 2006.

- While BNL's safety record improved significantly in FY 2005 and 2006, with two periods of ~1 million hours without a DART case, the safety of employees and contractors is a foremost concern. For FY 2006, the TRC target has been exceeded, with the number of DART cases at the target.

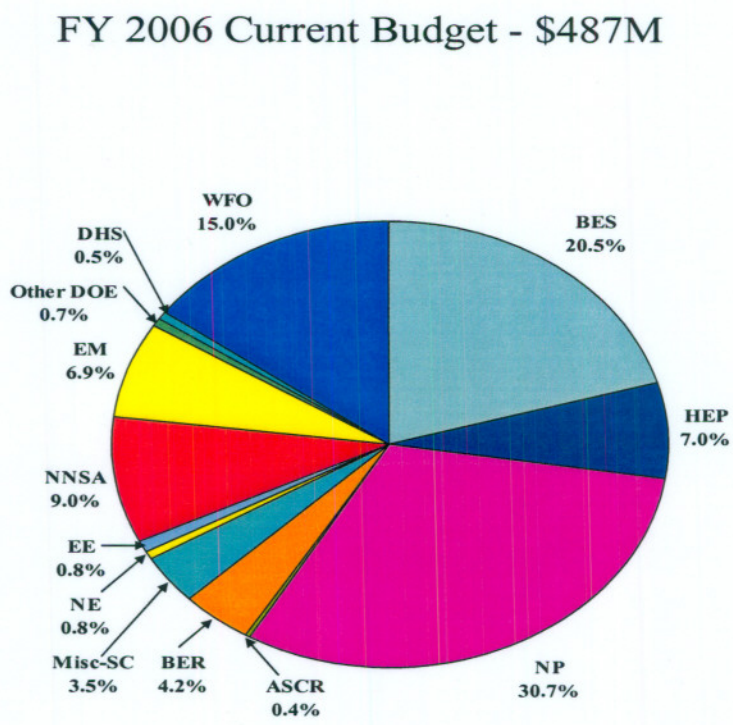
- The cost of doing business is a significant concern at BNL. In partnership with the State of New York, BNL currently enjoys an electric rate that is significantly below the local industrial rate. Because New York State views BNL as a key research facility within the State, it makes low cost power available to the site through its Power Authority Agency. BNL's mission is to operate large scientific user machines that consume large amounts of power. Without the New York State assistance, the cost of doing business at BNL would be prohibitive.

- Certain details related to the decommissioning of the High Flux Beam Reactor (HFBR) and the Brookhaven Graphite Research Reactor (BGRR) are of significant interest to the local community and other stakeholders. These include the end-state decisions, mid- and long-term facilities disposition and management; along with how the DOE will acquire these end states. It is essential to the success of these decommissioning projects that the existing positive partnership with stakeholders continue, based on open, frank and timely dialogue.

3. CURRENT AND PLANNED BUDGET

The pie chart provided below (Figure 3.1) illustrates the FY 2006 funding for Brookhaven National Laboratory based upon the current year budget. The subsequent charts (Figures 3.2 and 3.3) represent the planned future expenditures based upon the President's OMB request for 2007 (Figure 3.2) and an appropriately escalated projected level of funding requested for FY 2008 (Figure 3.3).

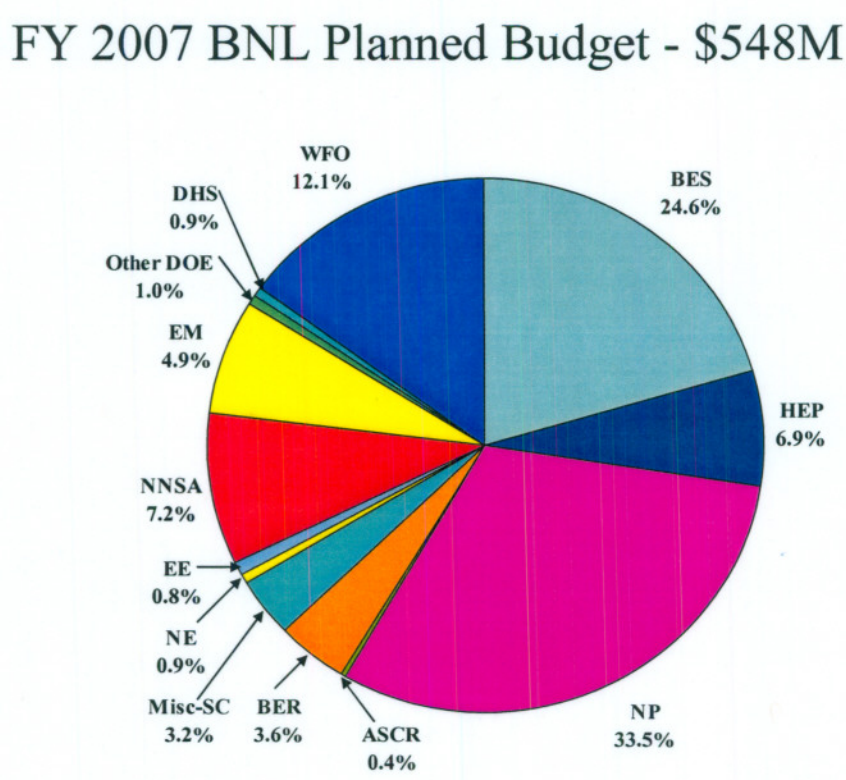
Figure 3.1: Brookhaven National Laboratory FY 2006 Funding Source Distribution



The FY 06 Office of Science programs (BES, HEP, NP, ASCR, BER, and Miscellaneous SC) represent approximately 66% ($322.7M), Work for Others (WFO*, Non DOE) represents approximately 15% ($73.1M) and DHS along with other DOE programs represent approximately 19% ($91.3M) of the total funded amount of $487M.

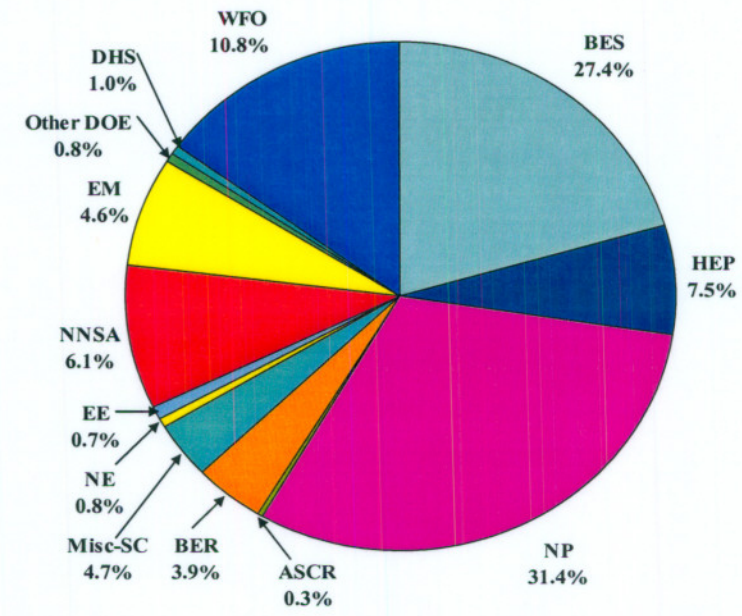
*Note: WFO consists of funding from Other Federal Agencies, Private Entities, Inter DOE Laboratory Work and Cooperative Research and Development Agreements.

Figure 3.2: Brookhaven National Laboratory FY 2007 Funding Source Distribution



The FY 2007 Office of Science programs (BES, HEP, NP, ASCR, BER, and Miscellaneous SC) represent approximately 72% ($395.7M), Work for Others (WFO, Non DOE) represents approximately 12% ($66.3M) and DHS along with other DOE programs represent approximately 16% ($86.1M) of the total planned budget amount of $548M.

Figure 3.3 Brookhaven National Laboratory FY 2008 Funding Source Distribution



The FY 2008 Office of Science programs (BES, HEP, NP, ASCR, BER, and Miscellaneous SC) represent approximately 75% ($488.2M), Work for Others (WFO, Non DOE) represents approximately 11% ($69.9M) and DHS along with other DOE programs represent approximately 14% ($91.2M) of the total funded amount of $649M.

Contingency Plans - The effect of reduced appropriations is always a concern for BNL and would be mitigated as follows:

- Depending upon the size of the reduction, planned work scope would be adjusted and staffing levels would be reduced accordingly.
- Departmental budgets would be reviewed for efficiencies and cost saving measures.
- Non-essential projects would be rescheduled or canceled.
- Re-prioritization of efforts would be coordinated among the various program offices.

4. MANAGEMENT APPROACH

The management of work at Brookhaven National Laboratory (BNL) is a formalized process that incorporates requirements stemming from DOE Directives, most importantly Work Authorization (DOE O 412.1A), DOE Oversight (DOE O 226.1) and Project Management (DOE O 413.3), and are supplemented with established Office of Science Guidelines and other requirements specified in the prime contract. The following discussion outlines the major activities used to manage work at BNL:

- Plan the work – establish the baseline for the work to be performed including the expectations and or performance levels
- Perform the work – execute the plan in accordance with the prescribed parameters
- Document Results – record the results in accordance with the baseline
- Analyze the Progress – determine if the work meets expectations; determine if baseline changes are needed
- Provide Status – document results, findings, recommendations and observations.

The prime contract defines the scope of work to be performed at BNL in general terms. The more specific definition is found in various other documents including field work proposals, work authorizations and work sponsoring agreements from Non-DOE entities. In order to ensure that the appropriate DOE requirements and expectations are incorporated into the contract for the projects and programs to be performed at BNL, various key activities take place such as:

1. Perform Strategic Planning (SC HQ)
2. Identify the need for the work and requirements/expectations (SC HQ)
3. Identify BNL as the source for performing the work; this includes a review of BNL capabilities, previous year's work results and any other reviews or advisory committee recommendations (SC HQ)
4. Prepare SC Budget with BNL allocation (SC HQ)
5. Prepare Field Work Proposals or Project Plans (BNL)
6. Review Field Work Proposals and Project Plans (SC HQ and Brookhaven Site Office (BHSO))
7. Issue Guidance/Funding Letters (based on Congressional appropriations) (SC HQ)
8. Establish Performance Measures (SC HQ and BHSO)
9. Incorporate the baseline work and performance measures into the BNL contract through a contract modification.

A contract modification and a work authorization form are the formal baseline approval and authorization to proceed with work. The contract modification and work authorization form references the SC HQ guidance letter. This guidance letter is, in turn, based on the BNL prepared Field Work Proposals or Work for Other's proposal. This process applies to all work. If a new activity is identified during the year and needs to be initiated right away than steps 4 through 9 will be used and the timeframes for completing those steps may be shorter.

Establishing a system for modifying the baseline allows for a change in plans. These changes can include directed changes from DOE or requests for change from BNL. The process used to modify the baseline is the same one used to approve the original baseline. In this case, it will be a contract modification based on a revised HQ guidance letter. Baseline changes can result from a number of sources such as, a change in funding, modifying the research to reflect achieved results, change in priorities, user needs, etc. In addition, some changes do not impact the work baseline. These changes can be issued as technical direction from BHSO.

Managing the work to meet the approved baseline is considered the implementation or execution phase and includes a wide variety of functions. Managing the work consists of internal BNL processes and external processes conducted by DOE. The following key activities are performed during the execution by BNL.

1. Initiate work based on approved baseline for the year

2. Monitor work through periodic review of progress against expectations and identify issues and actions

3. Take/implement actions

4. Report issues and progress

5. Perform self-assessments against the work baseline and other performance expectations

The following activities are performed by DOE (SC and BHSO) to measure BNL's performance in meeting the baseline:

1. Perform operational awareness activities including walk-throughs, facility representation, meetings and ordinary document approvals

2. Conduct various types of reviews, evaluations and assessments (SC HQ and BHSO)

3. Evaluate performance periodically under the contract performance measures (quarterly)(BHSO)

4. Identify any performance issues based on reviews and evaluations (SC HQ and BHSO)

5. Assess the M&O performance and pay fee (SC HQ and BHSO)

6. Provide formal feedback to BNL on their performance (BHSO, SC HQ)

Reporting includes collecting the information, analysis, and providing reports to management. Reporting provides management with the necessary information for them to make decisions about priorities, changes, and new initiatives. BNL provides and BHSO collects budget and performance information that is provided to SC HQ. This occurs through a number of mechanisms. These include:

1. Development of an overall priorities for DOE (annual)
2. Identification of performance measures for the Program Assessment Rating Tool (PART) (annual)
3. Submittal of the proposed DOE budget to OMB (annual)
4. Defense of the DOE budget to OMB (annual)
5. Defense of the DOE budget to Congress (annual)
6. Submittal of data against the program measures as part of the OMB (PART) (annual)
7. Report on progress submitted to the DOE Joule System (quarterly)

This information is then integrated and used in SC strategic planning and the development of baseline plans for work.

5. SITE INFRASTRUCTURE

The Laboratory's infrastructure is considered to be a major platform for the science and technology mission. The success of many of BNL's user facilities depends on the contributions of the approximately 4,000 visiting scientists who use them each year. Accordingly, the goals and objectives for infrastructure are derived directly from BNL's strategic science planning. Thirty percent of BNL's 5,320 acre site is developed. Many buildings date back to World War II, some earlier. Most major permanent facilities are the DOE/SC facilities built in the 1950s and 1960s, excluding those constructed for RHIC, which were built in from the 1970's to the 1990's. Those that remain are wells and treatment facilities supporting the DOE-EM's environmental remediation programs that are expected to move from the DOE-EM to the DOE-SC in FY10. Only recently has there been an effort to revitalize BNL. Through the building of a Research Support Facility and the Center for Functional Nanomaterials (CFN), two new facilities will be completed in calendar year 2006.

In the next few years, BNL will concentrate on building the world-class capabilities of NSLS-II and nanoscience at the CFN and across the Laboratory. During this period RHIC will transition to a QCDLab and the Center for Translational Neuroimaging will continue with world-class distinction. In order for BNL to accomplish the goal of becoming the premier science laboratory in the world in chosen areas, it will be necessary to address critical infrastructure concerns. Paramount to this objective is implementation of infrastructure renewal, i.e., upgrades and enhancement needed to support the ever expanding scientific and technological base. The unique facilities in operation at BNL are dependent upon reliable uninterrupted utility services with sufficient reserve capacities to ensure unrestrained future growth.

Ten Year Site Plan

The Ten-Year Site Plan (TYSP), as required by DOE Order 430.1B, "Real Property Management", provides the framework for BNL's future vision for the site and facilities. In response to scientific priorities, BNL has formulated infrastructure projects, as described in the TYSP, in order to maintain mission-essential facilities, to provide new facilities in support of the BNL mission and to meet the goals expressed in the "DOE Office of Science Strategic Plan". BHSO is responsible for the development of the annual TYSP which is ultimately forwarded to SC for approval.

The process used to develop the TYSP requires the integration of mission needs with programmatic goals and is produced in close collaboration with the cognizant DOE Headquarters offices, SC, BHSO and contractor personnel. The scientific basis and core assumptions that are integral to the prioritization of the projects listed in the TYSP are documented in the BNL Business Plan. Other documents used include the Site Master Plan, EM Life-cycle Baseline and Condition Assessment Surveys.

The TYSP contains a road map of activities and resources to achieve its goals to the extent fiscally possible. Each year projects are prioritized considering both risk/benefit and their potential to contribute to meeting BNL's goals. Maintenance related projects, are selected each year from backlog lists based on the evaluations of expert teams who consider, safety and health, urgency of the need based on condition, and potential to impact programs. The current TYSP includes a strategy to ensure that limited funds are applied to best address established goals and initiatives. Serious consideration in the process is given to the SC Laboratory Appraisal Process Performance Goal which states "Sustain Excellence in Operating, Maintaining, and Renewing the Facility and Infrastructure Portfolio to Meet Laboratory Needs".

Environmental Remediation

Brookhaven National Laboratory is on the U.S. Environmental Protection Agency's National Priorities List and significant remediation work has been completed under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). All soil, groundwater, and Peconic River cleanup projects are complete or associated remediation systems are in full operation. Comprehensive long-term monitoring is underway and will continue well into the future. The decommissioning scope for the Brookhaven Graphite Research Reactor (BGRR) has been determined. The removal of the BGRR pile and bioshield will be complete by 2009. Total project cost is about $97 million. The decommissioning scope is in development for the High Flux Beam Reactor (HFBR) and possibly for a third facility, the Brookhaven Medical Research Reactor (BMRR). The likely scope for the HFBR would complete near-term work by 2009, with final remediation work completed in approximately 75 years. Projected total cost is about $150 million. Public participation has been vigorous and valuable throughout the remediation program and is expected to continue as such.

Site Planning

Following the philosophy that infrastructure is a platform for research; a comprehensive process is used in the development of the Site Master Plan which utilizes approved strategic planning assumptions and program themes to focus the development of plan requirements to be consistent with the strategic vision of the Laboratory. The

development of a science-driven plan has stakeholder involvement including outreach to several specific groups:

- BNL employees, visitors and guests
- BNL Users and Scientific Advisory Committees
- DOE Brookhaven Site Office (BHSO)
- Community Advisory Council
- Civic Association leaders and community representatives
- BNL Department Chairs and Division Managers

The Laboratory's strategic science plan, as well as all stakeholder input, was essential to assessing the ability of the current infrastructure to support the rational evolution of current programs and to accommodate new ones that might reasonably be expected to come to BNL. Based on this data, planning assumptions were developed; shortfalls in current infrastructure ("gaps") were discussed in terms of capability, condition, and location. From that, requirements were generated to meet the identified infrastructure goals. Planning efforts aim to optimize the physical plant to support the needs of BNL as a forefront scientific research institution.

The planning process addresses the need for new facilities to meet emerging research needs while making maximum use of existing facilities and assets. Integral to the planning process is the need to ensure safe, environmentally sound and cost-effective operations. The future development of the site is based on the continued need for large, facilities to maintain state-of-the-art capability and is planning to build the next generation of user facilities, during the next decade.

Land Use Planning

The BNL Land Use Plan is contained within the recently completed Ten Year Site Plan (TYSP) and was revised to reflect the current Site Master Plan and BNL's Strategic Plan. The plan provides the specific details relative to the current configuration of the Laboratory including the impact of the rich history of the BNL site wherein several areas and structures have been identified as cultural resources. These culturally/historically significant assets are appropriately managed to ensure that they remain available for public and scholarly interpretation as well as compliance with cultural resource regulations.

The Land Use process categorizes current land use into the following categories:

- Open space/wilderness - including protected wildlife and critical habitats, scenic vistas
- Industrial/commercial - e.g., research and development facilities, offices, manufacturing plants, rail yards, staging areas, power plants, utility systems, and waste management facilities

- Residential - e.g., permanent and temporary housing, dormitories
- Agricultural - e.g., farming, grazing, and aquaculture
- Recreational - including passive and active uses
- Native American - including traditional, cultural, and religious uses.

Of these potential six categories, four were considered applicable for the BNL site: open space, industrial/commercial, agricultural, and residential. Each of these four categories was assessed and the land use plan delineates the future plans and the accompanying impact. Planning for future land use is accomplished through meetings, program reviews, interaction with DOE, and contributions from Laboratory staff, collaborators, and external stakeholders to ensure that local area considerations are recognized and mitigated.

BNL plans to preserve as much area as possible in its natural state while carrying out its mission to support the DOE through leading-edge user research facilities, research and technology development, educational efforts, and industrial involvement. In November 2000, DOE designated 530 acres of BNL property as the Upton Ecological and Research Reserve in order to protect a unique ecosystem of Pine Barrens forests and wetlands, and foster ecological research and educational opportunities.

To the north and west of BNL, the area is largely wooded, privately owned, and zoned for residential development. The area between Upton Road, William Floyd Parkway, and Princeton Avenue will be kept as a buffer zone with forest and grassy areas. The anticipated expansion of major Laboratory buildings is to the east (NSLS-II) and in the RHIC area in the north central area of the site. BNL's holdings to the east are primarily woodlands and wetlands and plans are to leave them in their natural state for the foreseeable future. The Center for Functional Nanomaterials is now under construction on a former developed site. The Research Support Building is under construction in the core area of the site, also on previously developed land.

BNL will continue to fulfill its mission of constructing and operating large experimental facilities that encourage the participation and support of the outside user communities (scientists and engineers from the United States and abroad) to maintain U.S.'s pre-eminence in basic research. The planned research facilities, when built, will substantially increase the number of visitors and users.

6. CONTRACT CONFIGURATION

The contract configuration for Brookhaven National Laboratory (BNL) is a management and operating (M&O) contract, as defined in FAR 17.6 and DEAR 917.6. The DOE Prime Contract for BNL is a performance based, cost-plus award fee contract whose term expires January 4, 2008. As the current contractor, Brookhaven Science Associates, LLC (BSA) is tasked with accomplishing the missions and programs authorized by DOE as they manage and operate the Laboratory under this Performance-Based Management Contract (PBMC). The contract funding is estimated at approximately $500 million annually.

The Brookhaven Site Office (BHSO), co-located at the Laboratory, has direct responsibility for the management and administration of the performance-based M&O contract between DOE and BSA. BHSO has the responsibility of ensuring that the contractor is operating the laboratory and performing the mission in a fiscally responsible and safe manner in accordance with the terms of the contract. The BHSO Contracting Officer authorizes work, obligates funds, maintains the Prime Contract terms and conditions and executes contract modifications when warranted.

It is the Contractor's responsibility to develop and implement innovative approaches and adopt practices that foster continuous improvement in accomplishing the mission in accordance with the terms and conditions of the contract. The expectations of the PBMC approach are that the Contractor will produce highly effective and efficient management of the Laboratory, resulting in a safe and secure environment, outstanding science and technology results, more cost effective operations and enhanced contractor accountability.

The primary contract performance measurement mechanism is the Performance Evaluation and Measurement Plan (PEMP) as delineated in the contract. The PEMP provides the standards against which the Contractor's overall performance of scientific, technical, operational and/or managerial obligations under this contract are assessed. Specific performance measures are developed by DOE and then mutually agreed upon with the contractor. On an annual basis, these measures are evaluated and become the basis for the total fee determination.

APPROVED: M. Holland 7/21/06

Michael D. Holland, Site Manager — Date
Office of Science
Brookhaven Site Office

CONCURRENCE: _____ _____

George J. Malosh, Chief Operating Officer — Date
Office of Science